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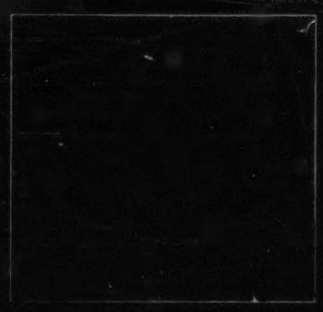

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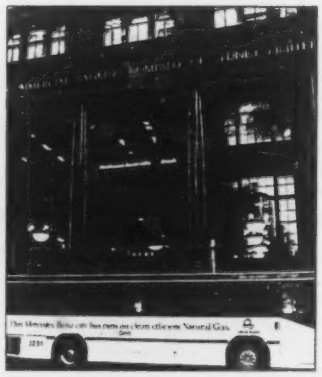

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This natural gas-powered transit bus, part of Australia's effort for NGV's proudly proclaims its contribution to Sydney's environment.

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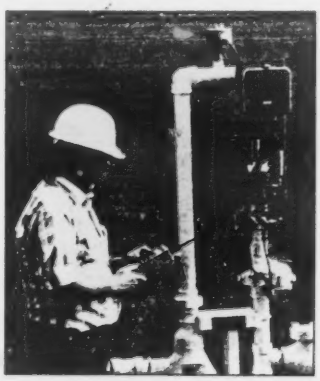

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The Australian Natural Gas Industry

By R.D. Palmer
General Manager
Gas and Fuel Corp. of Victoria,
Melbourne, Victoria, and President,
The Australian Gas Association,
Canberra, ACT, Australia

The land area of Australia is almost as great as the U.S. but the country has only a tenth of the population. By mid-1990, 17 million people lived in Australia, more than 85% of them located in urban areas.

Australia is a federation of six sovereign states. The federal government has a dominant role in many of the nation's affairs, but the operation of gas networks is not one of them.

The six mainland states obtain their natural gas from a single source. With the exception of New South Wales and South Australia, which both obtain their gas from fields in the Cooper Basin, each state's source is exclusive. The Northern Territory has its own source of gas, but the Australian Capital Territory draws on the same source as does New South Wales.

Although provincial cities are being added to the gas supply network, the bulk of natural gas systems is concentrated in the capitals cities. The trend of network expansion is expected to continue in New South Wales, Queensland and Western Australia.

Gas Supplies

Australia is well endowed with natural gas. Proved and probable reserves total approximately 81 Tcf, a reserves-to- production ratio of 105 yr. However, the particular sources currently supplying some states are expected to deplete sooner that that.

Some 81% of reserves are located in the west and north, far from the major demand centers in the southern and eastern states. Current sources of domestic supply are expected to be depleted at different times.

Comprehensive studies of natural gas supply and demand in Australia undertaken by The Australian Gas Association have indicated that gas supply in Australia is subject to significant economies of scale.

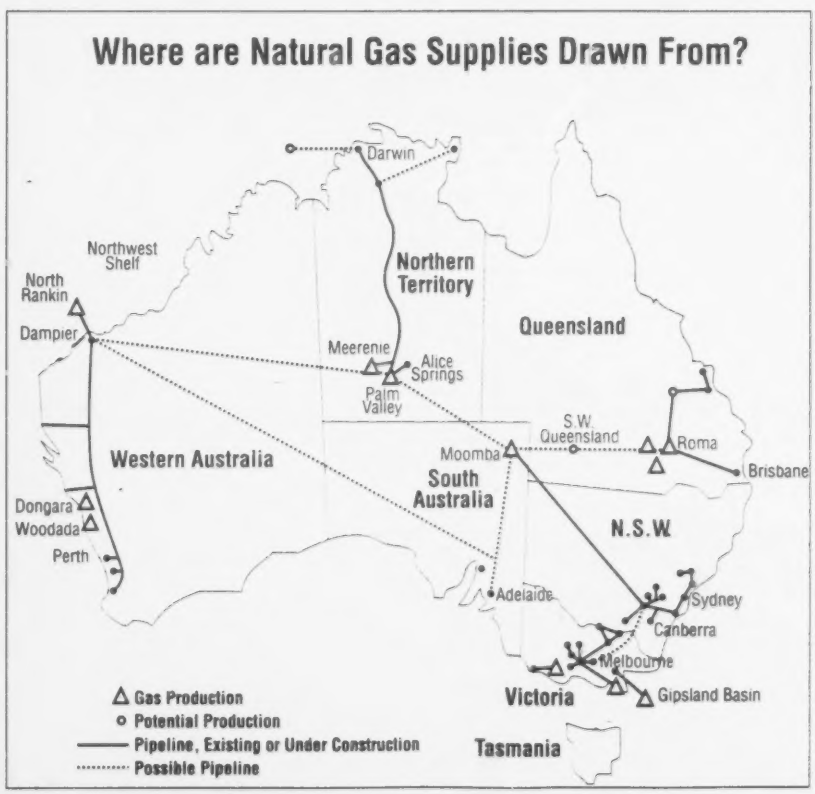
The most cost effective way of developing supplies in the future is by interconnecting the pipelines delivering gas to the southern and eastern states from the Gippsland and Cooper basins and linking them to the Amadeus Basin. This would enable these three sources to be depleted together, allowing large supplies from the north and west to be brought onstream with minimum buildup.

By 2010, when the new supply would be required, annual demand in the southern and eastern states is expected to reach 500 Bcf. This would require a pipeline of at least 40 in. (1,000 mm), allowing economies of scale to be exploited. The first link in such a national pipeline, between the Amadeus and Cooper basins, is currently being actively considered.

There are no federal government arrangements for actively coordinating or regulating the supply of natural gas in Australia. The only roles played by the federal government are indirect in its constitutional jurisdiction over exports and offshore exploration and development.

Federal jurisdiction over offshore exploration and development is exercised by regulation of permit allocation, exploration work programs and production licenses. All other regulation of natural gas supply and use is under the jurisdiction of the individual state governments.

The Australian Gas Association, a voluntary association of gas distribu-



Australian Gas Utilities

Fiscal Year 1990

Company	Gas Revenues (MM A$)	Number of Customers	Miles fof Main	Employees
Gas and Fuel Corp. of Victoria	$806.8	1,170,000	14,322.7	6,129
The Australian Gas Lignt Co.	$532.9	550,000	9,920.5	2,571
State Energy Commision of Westerm Australia	$461.4	243,000	6,352.8	536
SAGASCO	$153.0	270,000	3,683.2	1,047
Gas Corp. of Queensland Ltd.	$30.0	67,000	809.8	404
Allgas Energy Ltd.	$40.5	48,000	882.4	333

tion utilities, with associate membership of gas producers and other industry participants, is the principal group acting on behalf of the industry at the national level.

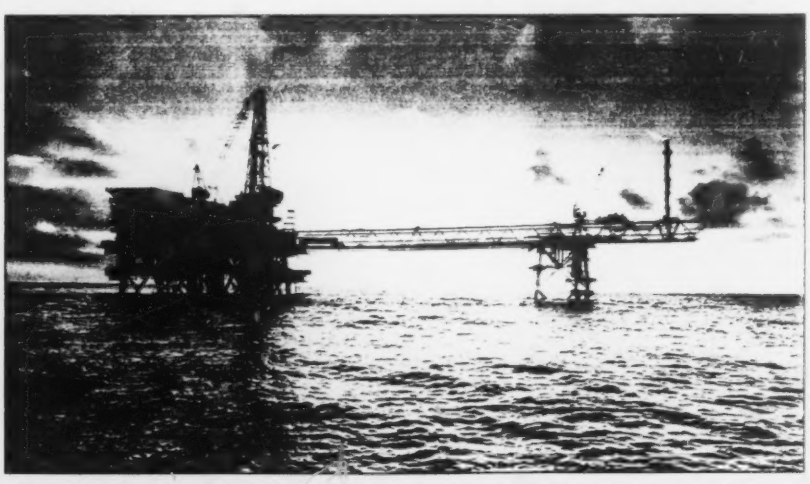
Production/ Transmission

Australian gas production has increased rapidly over the past 10 yr, from approximately 360 Bcf in 1980 to almost 800 Bcf in 1990. However, over the same period the reserve-to- production ratio has increased from 81 yr in 1980 to the current ratio of 105 yr.

The pipeline network, which gathers natural gas from the producing fields and transports it to major consuming centers, has grown to almost 7,500 miles (12,000 km).

Most of the major gas transmission pipelines in Australia were completed between 1969 and 1971. The network has continued to expand over the past 20 yr.

The main owners and operators of the gas pipelines are the utility companies, including Gas and Fuel Corp. of Victoria, the Australian Gas Light Co. and the government-owned State Energy Commission of Western Australia. Two government enterprises, the Pipeline Authority of South Australia and the federal Pipeline Authority, also own and operate mainline transmission systems.



Natural gas produced from the North West Shelf offshore fields is shipped to Japan as LNG or transported to cities in southern Western Australia, including Perth.

Gas Distribution

Distribution networks for town gas were built in most capital cities long before natural gas became available in the late 1960s. As a result, institutional arrangements for gas distribution are the result of evolution over many years.

Given Australia's population and size, it is not surprising that each state has its own unique arrangements for distributing natural gas. These arrangements cover the range from wholly owned state government enterprises to private companies.

With the exception of Queensland, which has two gas utility companies, states have a single utility for gas distribution. Western Australia is the only state in which gas and electricity distribution are under the control of a single organization, the wholly-owned state government enterprise State Energy Commission of Western Australia.

Victoria is the dominant state in residential gas sales, while Victoria, New South Wales and Western Australia all have significant industrial sales. Electricity generation market for natural gas is dominant in South Australia and the Northern Territory.

Future Demand

Natural gas will provide 17% of Australia's primary energy in 1990-91, compared to a 6.6% share in 1973-74.

Natural gas' increased share of the total national energy picture is largely accounted for by the displacement of increasingly expensive oil-based fuels. By 1990-91, the contribution of heating oil, industrial diesel fuel and fuel oil to final energy demand has declined to 3.8%, down from 17.1% in 1973-74.

The manufacturing sector is the most important consumer of natural gas. The share of natural gas in electricity generation is primarily constrained by past commitments to large base-load coal-fired plants and overcapacity in New South Wales and Victoria states.

The increasing consumption of natural gas in the mining sector is largely associated with gas consumed in pro-

Australian Pipeline Mileage as of July 1, 1990

(Miles)

Onshore Transmission	New South Wales	Victoria	Queensland	Southern Australia	Western Australia	Northern Territories	Total
Natural Gas/LPG	1,259	1,254	599	654	1,466	1,120	6,352
Crude Oil/Liquids	0	265	687	409	0	168	1,529
Total	1,259	1,519	1,008	1,063	1,466	1,288	7,881
Onshore Gathering							
Natural Gas/LPG	0	73	221	292	7	0	586
Crude Oil/Liquids	0	188	86	210	21	0	505
Total	0	261	307	502	28	0	1,091
Offshore							
Natural Gas/LPG	0	153	0	0	102	0	255
Crude Oil/Liquids	0	166	0	0	27	0	193
Total	0	319	0	0	129	0	448
Totals	1,259	2,099	1,315	1,565	1,623	1,288	9,420

duction and processing of natural gas and crude oil, including gas production shipped to Japan as LNG.

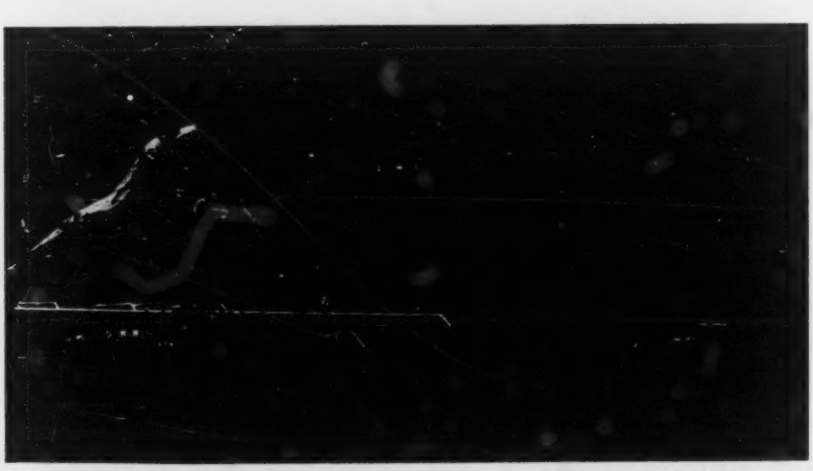
Future Developments Studies by The Australian Gas Association and other bodies have shown gas is strongly competitive with coal for peak- and intermediate-load electricity generation in Australia.

The lower capital costs of gas turbine and combined-cycleplants more than compensate for the higher cost of natural gas as a fuel. Generating costs could be reduced by 15% on the average if 50% of the generating capacity were gas turbine and combined cycle plants.

The full potential of gas for electrical generation will not be reached until about 2010 because of the over-capacity of generating plants in the southern and eastern states and the time needed to retire existing facilities.

By this time, large supplies could be available from gas sources in the west and north. Gas required for electricity generation could total 300 to 400 Bcfy by 2010, enabling the realization of further economies of scale in gas supply.

Natural gas vehicles are under development in Australia and a number of state government transport operators have purchased and are continuing to purchase natural gas-powered buses for public route service. Part of the motivation for support by the government for development of NGVs in Australia is the decline in indigenous oil reserves and the availability of large, economic supplies of domestic natural gas.



The gas processing facility in central Australia treats natural gas produced from the Moomba Field, in South Australia state.

Conclusion

The gas industry in Australia looks forward to continued growth in its traditional markets and development of new markets in transport and electricity generation.

Abundant reserves are available to meet these demand. The challenge to the industry is to ensure that the transition to long-distance, trans-continental transmission of Australia's gas reserves is carried out effectively and efficiently. —P&GJ

Asia Pacific Turns to Gas

By William S. Scholes
P&GJ Correspondent,
Sydney, Australia

The Persian Gulf War brought home to the countries of Southeast Asia, in particular, how finely balanced their economies are when Middle East oil supplies are threatened.

The war has given further impetus to the proposed ASEAN (Association of South East Asian Nations) gas pipeline, a $10-billion to harness the gas resources of the Asian Pacific region. The project will enable power generators and industrial facilities to convert from oil to natural gas, reducing region's dependence on Middle East oil imports, currently at 73% of total demand or 12.7 million bbl per day.

An estimated 60% of the world's population lives in Asia Pacific, more than 3 billion people. For every point of growth in gross national product, countries in the region require an increase of 0.8% in energy demand. Southeast Asia is currently reporting the highest economic growth rate in the world, with Malaysia for example averaging 8% growth over the last 3 yr.

Asian Pacific oil demand is expected to expand at an average of 3% annually, with consumption in countries such as South Korea, Thailand, the Philippines, India and Pakistan likely to increase more than the average. Petroleum consumption in Singapore and Malaysia will be lower than average due to substitution by natural gas.

Most countries in the Asia Pacific region are now offering improved contract terms or permits for gas and oil exploration in another effort to reduce dependence on Middle East energy supplies. The most active countries with planned field developments are Malaysia, 52 fields; India, 41; Australia, 36; Indonesia, 35; China, 29; Thailand, 13; and Brunei, 12.

Japan's Approach

BHP Petroleum, Australia, has been approached by a Japanese petrochemical company to supply natural gas condensate from the North-West Shelf project under long-term contract, the first step in diversifying Japanese industrial sources of feedstock supply.

The approach to BHP by Mitsui Petrochemical Industries is a part of a plan to diversify dramatically its raw material sources and curb its dependence on naptha supplies from the Middle East. Mitsui expects to raise the level of LPG and condensate used from 5% of total feedstock to 10% by the end of 1991 and to 40% by 1993.

The proposed Japanese contracts may mean a sharp increase in the volume of Australian NGL exports to Japan. It is the first time a Japanese company has moved to lock-in supplies of condensate as an alternative to naptha in plastics production.

Australian condensate producers would have to follow the lead set by Santos Ltd. to convert NGL into naptha prior to export. A recently imposed surcharge of $2.50/bbl on all Japanese imports of crude oil or condensate does not apply to naptha.

Condensate from the North-West Shelf project, operated by Woodside Petroleum Ltd., is prized by the Japanese as a potential replacement for

naptha. The North-West Shelf project does not have the infrastructure to export its condensate as naptha.

The North-West Shelf gas project could be expanded to include the production of LPG in addition to its large-scale LNG exports to Japan. The LPG option has been under almost continual consideration since the project was originated more than a decade ago.

Gas from the North Rankin field is unusually dry and free of NGL, which are used to produce LPG components. The Goodwyn gas field, which will come on-stream in 1993, contains far more liquid hydrocarbons, making the extraction of LPG more viable.

Indonesia To Benefit

Indonesia is planning to build three more LNG production trains, each with an annual production capacity of 2.3 million metric tons.

The first is to be completed by 1994 with the other two by the end of the decade. When all are on-stream, Indonesia's LNG production capacity will be 26.5 million metrics tons per year. Indonesia currently exports 17 million metric tons/yr of LNG to Japan, 2 million metric tons/yr to South Korea and 1.5 million metric tons/yr to Taiwan, all under 20-yr contracts. All are currently negotiating with Petromina, Indonesia's state energy company, for increased supplies.

Large gas discoveries in the Natuna Sea will be developed and the gas transported to markets in Singapore and Sumatra. Singapore will receive 140 MMcfd from Natuna Sea field, which has reserves estimated at 45 Tcf, half of Indonesia's total. Esso is considering several options for developing the field, including construction of a grass-roots LNG plant on Natuna Island.

Under consideration are a pipeline system connecting the whole length of Sumatra and Java, a 280-mile (450 km) pipeline network from the Kangean gas field offshore Madura Island to Surabaya in East Java and a 300-mile (480 km) pipeline via Batam and Singapore to South Sumatra. The Batam- Singapore pipeline will cost $700 million and take 3 yr to build.

ASEAN Pipeline

An Italian-French consortium is studying the economic and technical feasibility of the $10-billion trans-ASEAN gas pipeline project, with a report due soon. Consortium members include Agip, Agip Petroli, Gaz de France, IMI, SNAM, Total and Trans Eng.

Geographical location of ASEAN members and the gas fields dictates a linear structure to the pipeline grid, making it easier to connect new fields and new markets.

The Trans-ASEAN pipeline system will consist of a main line that begins in the Gulf of Thailand and terminates on Luzon Island in the Philippines, crossing Thailand, Malaysia, Sumatra, Java and Borneo.

The system is divided into a seven-segment mainline and four branch pipelines. Each main segment will have a capacity of 53 MMcfh or 425 Bcfy. Branch lines will have varying capacities. Gas will move in both directions between the Kerteh Field in Malaysia and the Surabaya Field in Java, as well as in northeastern Kalimantan.

The entire system will consist of 4,950 miles of pipeline, including 3,900 miles of mainline, and a total of 21 compressor stations. The offshore segments will total 680 miles.

Geographical location of ASEAN members and the gas fields dictates a linear structure to the pipeline grid, making it easier to connect new fields and new markets.

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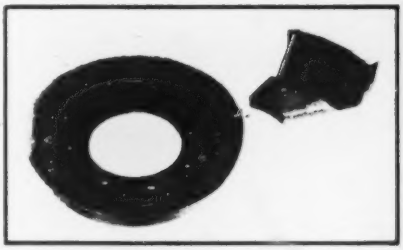

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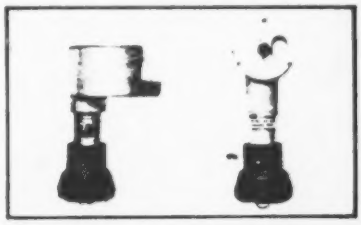

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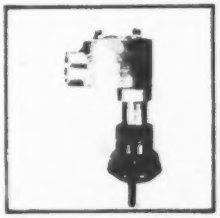

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Natural Gas Reserves in ASEAN Countries

Company	Natural Gas Reserves, Tcf	Percentage of ASEAN Reserves
Brunei	11.7	8
Indonesia	83.2	54
Malaysia	53.5	34
Phiippines	—	—
Singapore	—	—
Thailand	6.5	4
Total Proven Reserves	**154.9**	**100**
Estimated Probale Reserves	100.6	

The seven major segments are:

- Gulf of Thailand to Kerteh: 528 miles of pipeline, including 99 miles of offshore pipeline and 429 miles of onshore line, and three compressor stations.
- Kerteh to Malaysia: 193 miles of pipeline, one compressor station, bi-directional flow.
- Malaca to Merak: 732 miles of pipeline, including 71 miles of offshore line and 661 miles of onshore pipeline, and three compressor station. Bi-directional flow.
- Surabaya to Sepasu: 661 miles of pipeline, including 233 miles of offshore pipeline and 428 miles of onshore pipeline, and four compressor stations.
- Sepasu to Kudat: 571 miles of pipeline and three compressor stations. Bi-directional flow.
- Kudat to Manila: 748 miles of pipeline, including 276 miles of offshore pipeline and 472 miles of onshore pipeline.

Singapore and Thailand—have total proven gas reserves of 155.4 Tcf (4.4 billion cu m). Indonesia and Malaysia account for 88% of the reserve total.

In 1988, ASEAN members produced 2.8 Tcf (83.4 Bcm), of which 2.4 Tcf (68.3) were marketed. Some 1.4 Tcf (40 Bcm) were exported to Japan and South Korea as LNG.

With 2 yr left in Brunei Darussalam's 20-yr LNG sales agreement with Japan, the eyes of the international gas industry are turning toward the sultanate.

The sales contract, covered the export of 5 million tons of LNG annually, is the first in a series of contract renewals that will be negotiated in Asia during the 1990s. Discussion will be under way as Japanese importers step up efforts to secure oil and gas imports from non-Persian Gulf sources.

Malaysian Diversification

Malaysian LNG has signed a letter of intent to supply 2.25 million metric tons of LNG per yr for 20 yr to Taiwan's Chinese Petroleum Corp. The LNG will be used by Taiwan Power Authority for electricity generation. Malaysian LNG has signed a similar contract with South Korea's Korea Gas Corp.

Previously the country's only LNG exports were to Japan, where Tokyo Gas and Tokyo Electric Power purchased a total of 6 million metric tons to 6.5 million metric tons annually. Malaysia LNG recently signed a agreement with Saibu Gas of Japan in 1990. Negotiations are continuing among Malaysia LNG and Toho Gas, Osaka Gas and Kansai Electric for additional sales.—**P&GJ**

An estimated 60% of the world's population lives in Asia Pacific, more than 3 billion people. For every point of growth in gross national product, countries in the region require an increase of 0.8% in energy demand.

Reserves that could be connected by the pipeline include fields in north, central and southern Sumatra; northwest Java; Natuna; East Kalimantan; Gulf of Thailand; South China Sea; central Luconia; and Brunei.

ASEAN members—Brunei, Indonesia, Malaysia, Philippines,

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